MICROTRONIC
electronic systems

RFID Media Formatting

with MDSedit / TML6

User Guide

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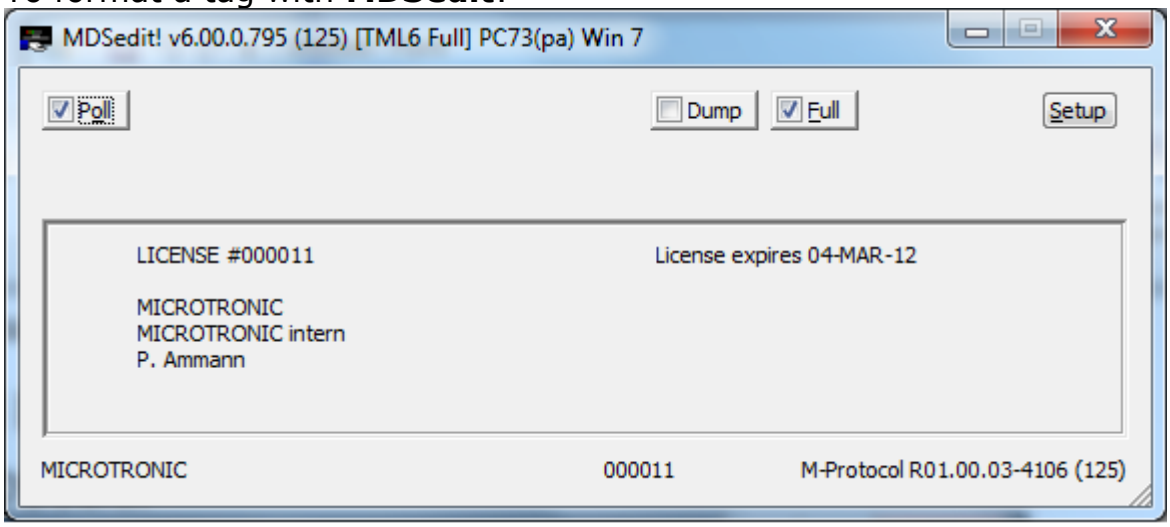
1. General Formatting Procedures

1.1 Format with MDSedit

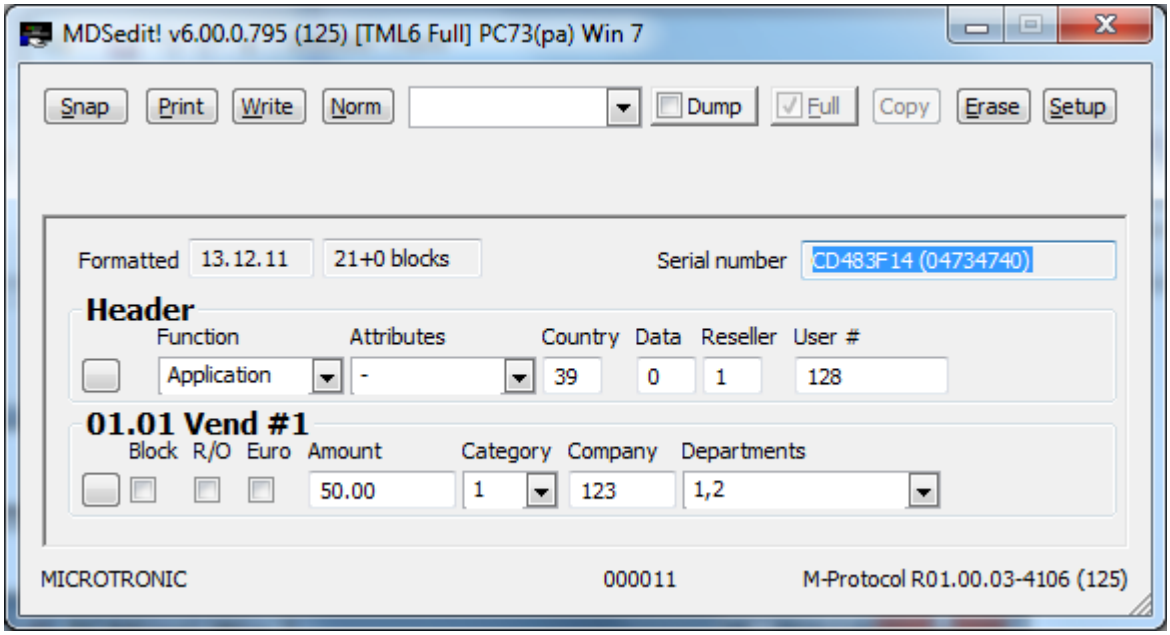
To format a new tag, a valid tag is required to be copied on

1.1.1 Insert a valid tag as original

To format a tag with **MDSedit**:

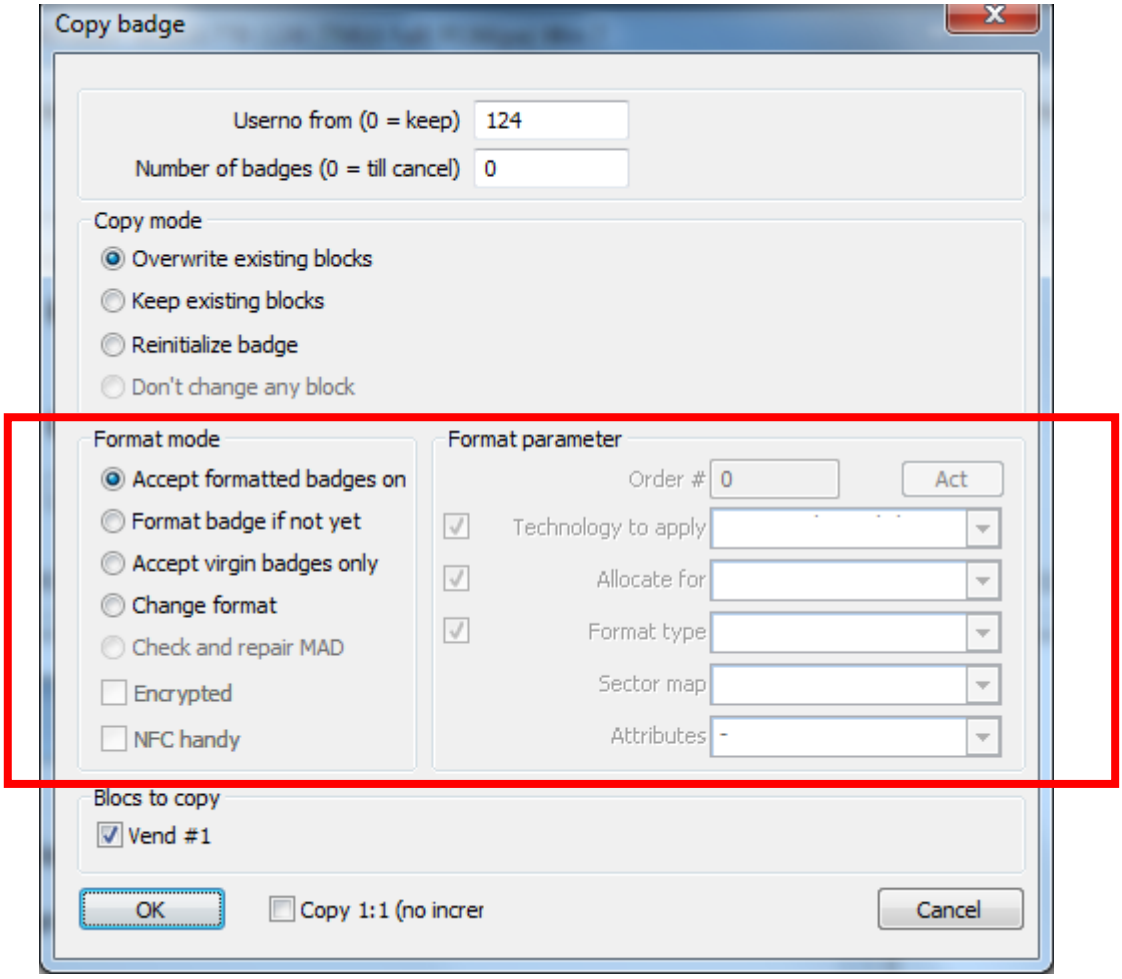


Insert an already programmed tag as original.



1.1.2 Invoke the copy dialog

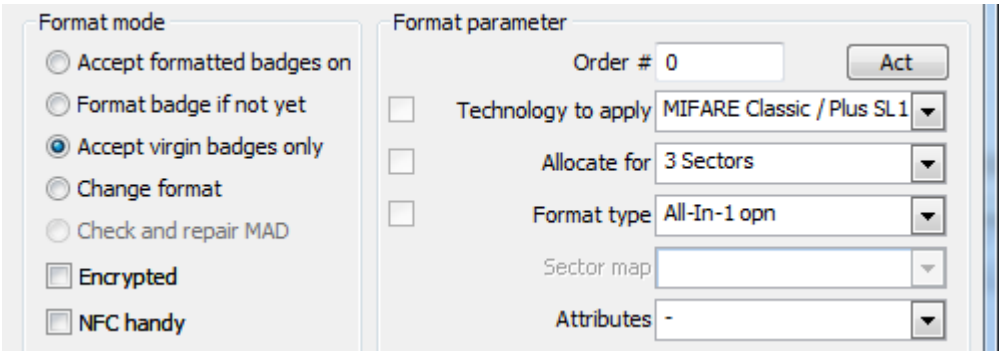
Click Copy, the copy dialog appears:

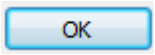


Note:
the reader must have format licenses or units (see chapter 5), else the copy dialog appears without format mode/parameter.

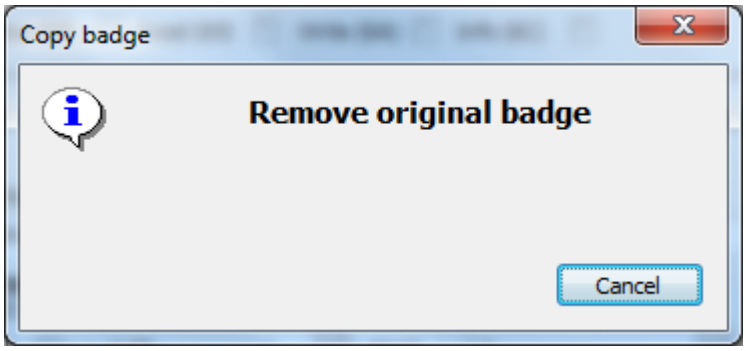
1.1.3 Select format, give the parameters and start

Choose under Format mode the option Accept virgin badges only and fill the Format parameter block, for example we choose here 3 sectors, All-In-1 open:



Now click 

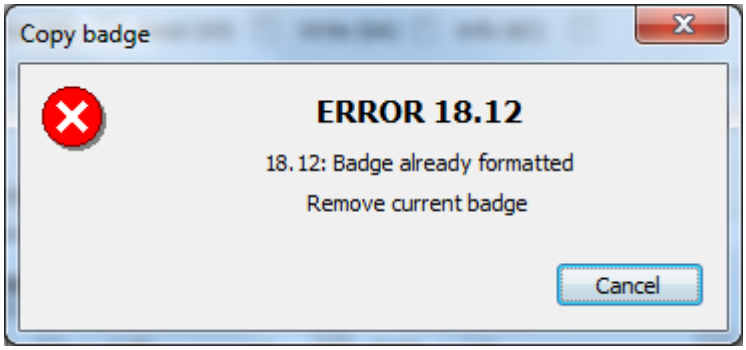
You will be prompted to remove the tag



1.1.4 Format next tag

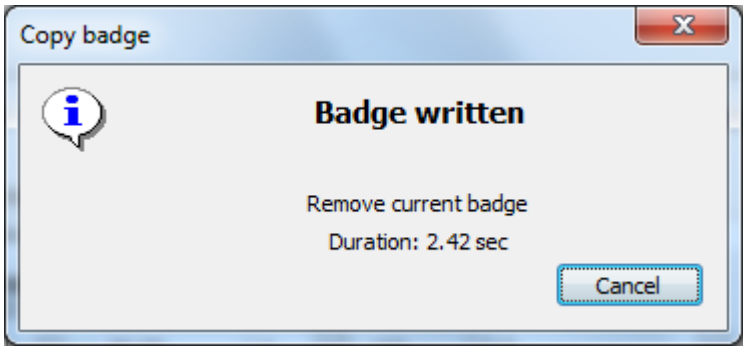
Then to insert a tag to be formatted

1.1.5 Format failure



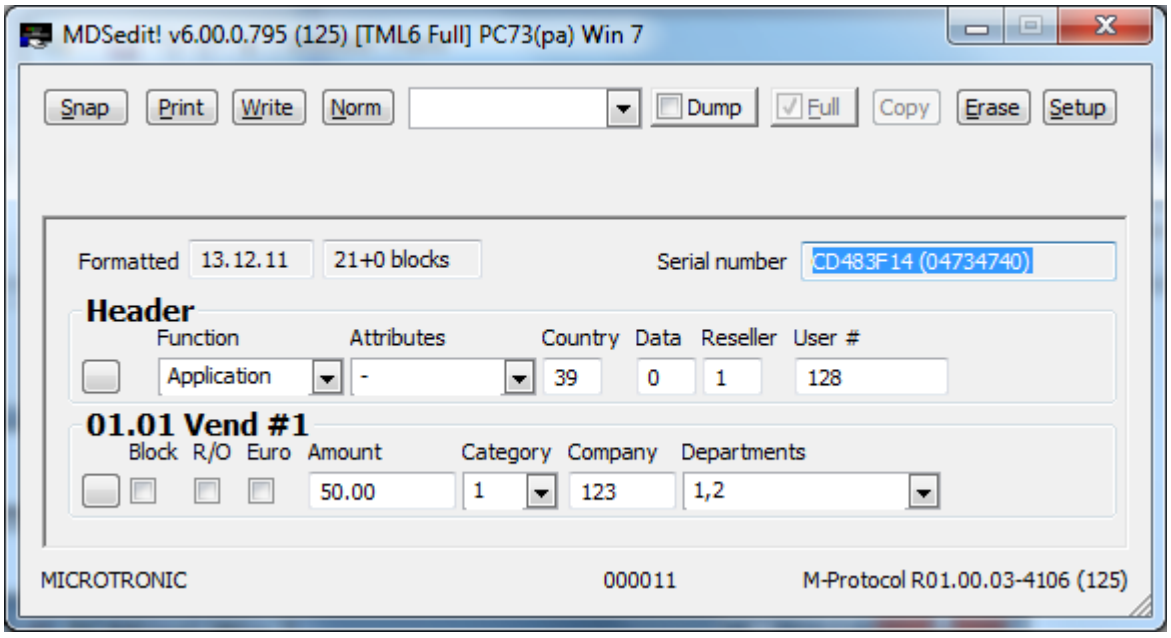
The option *Accept virgin badges only* was selected at 1.1.3, the tag inserted here was already formatted,

1.1.6 The tag is written OK



Removing the tag now asks for the next tag (at 1.1.4), but for verify the tag, click Cancel or press [Esc], the newly formatted tag is read in:

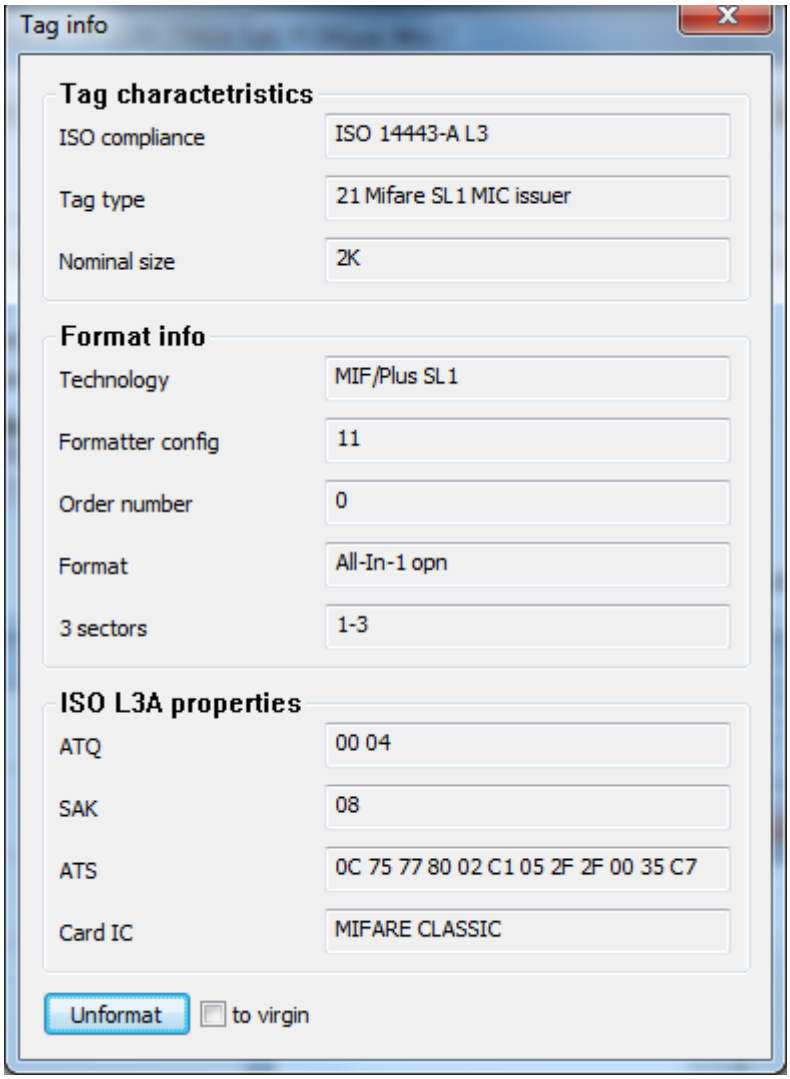
1.1.7 Verify the tag content



The tag content must be the same as the original (see 1.1.1), except that the User # is incremented by 1.

1.1.8 Verify the format info

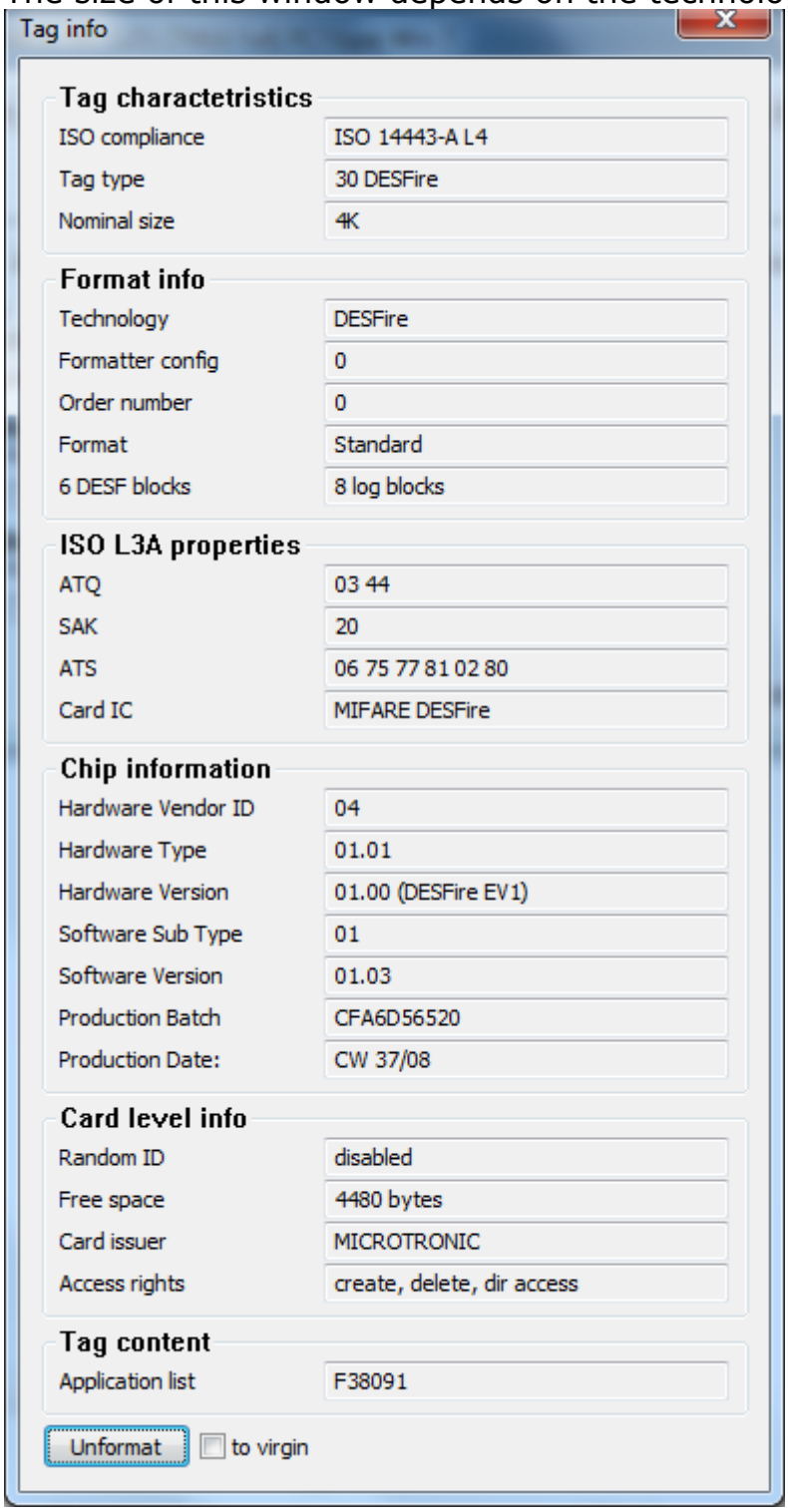
Now click on the prompt Formatted and the tag info appears:



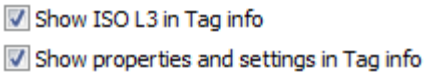
Under **Format info** verify the 3 sectors, All-In-1 open (choosen in the example at 1.4.3) **the test is done!**

1.1.9 Customize tag info window

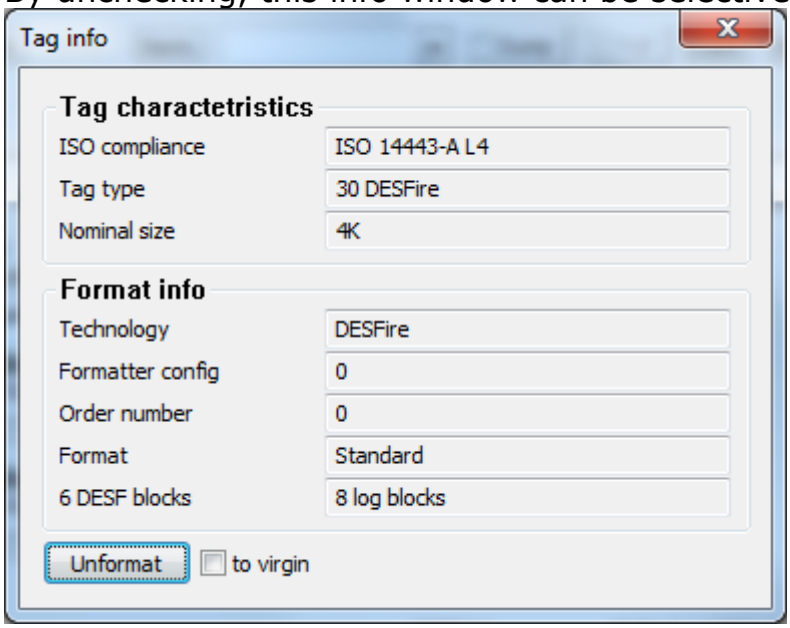
The size of this window depends on the technology of the tag:



Obviously this window is too big for a small screen (like a laptop) , to reduce it, click Setup, and choose the Advanced tab:

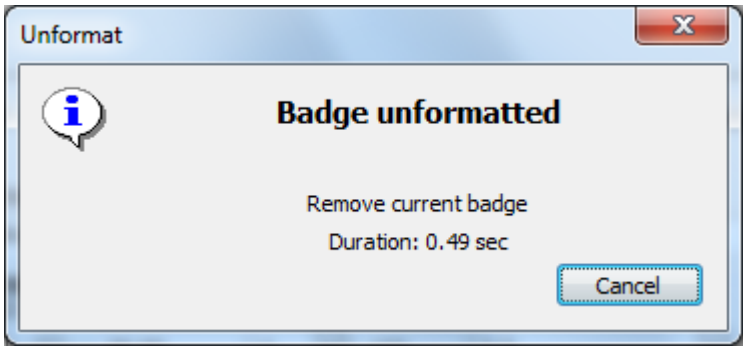


By unchecking, this info window can be selectively reduced to the essential:



1.2 Unformat with MDSedit

To unformat, insert a valid tag to be unformatted and click on the prompt Formatted, the dialog shown at 1.1.8 appears and click Unformat the unformat process starts immediately witout any further confirmation; after sucessfull unformat



Note:
not all technologies provide unformat.

Removing the tag now will prompt for the next tag to unformat:

Also click Cancel or press [Esc] to abort the process.

1.2.1 Verify tag successfully unformatted

[esc] or

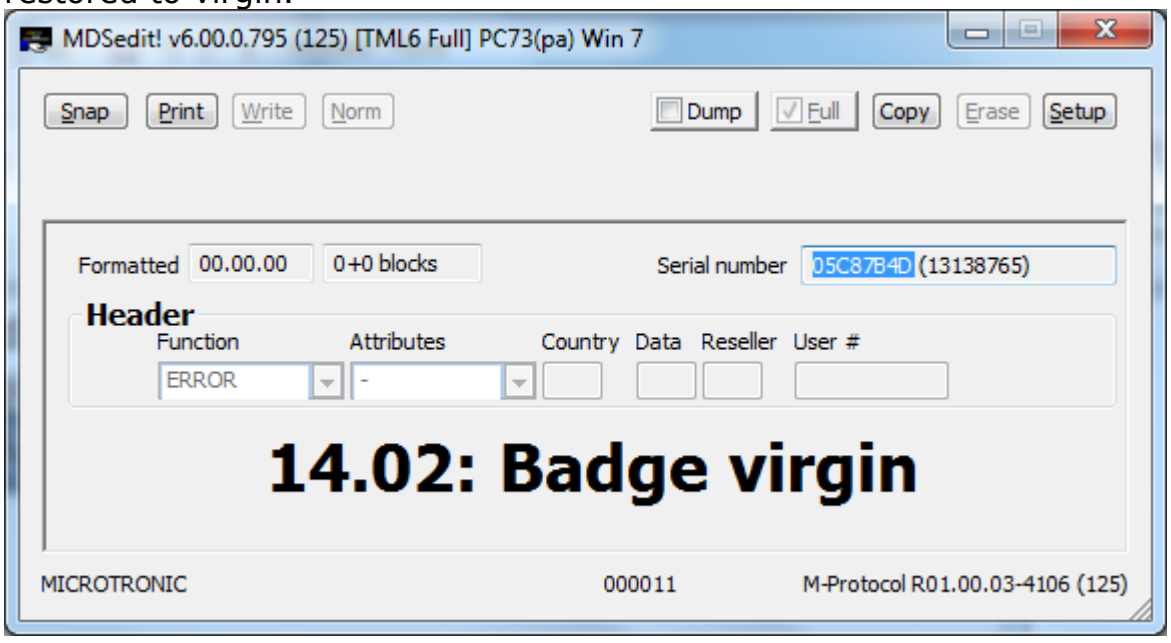
The tag is read back and the error code confirms that the U-KEY sectors are sucessfully deleted.

1.2.2 Verify tag successfully restored to virgin

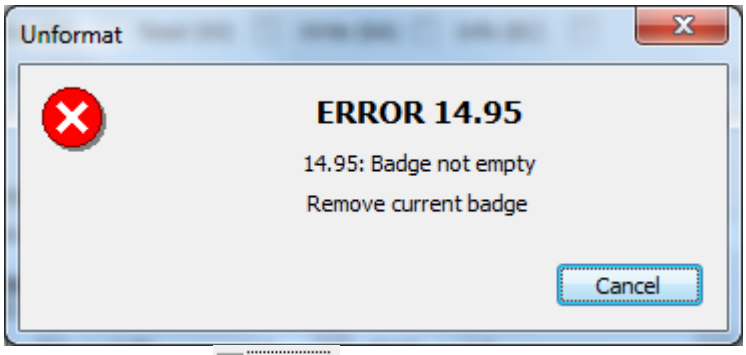
Check the corresponding box to restore to virgin (fill the whole tag so it was originally delivered), note that not all configurations allow this.

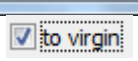
Once done, [esc] or

The tag is read back and the error code confirms that the U-KEY sectors are sucessfully deleted.
The tag is read back and the error code confirms that the tag is succesfully restored to virgin.



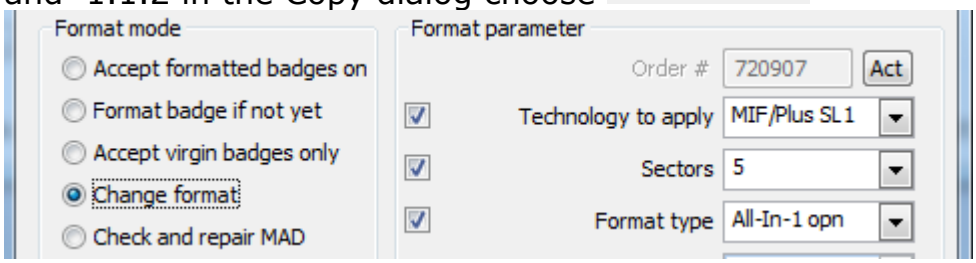
1.2.3 Tag unformat failed



In this case,  was checked in the dialog shown at 1.1.8 and the tag contains also 3rd party partition.

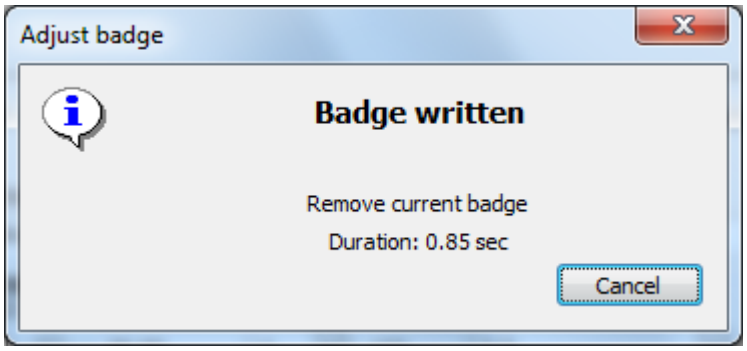
1.3 Migrate with MDSedit

To migrate a tag, insert the tag to be migrated and click Copy as shown 1.1.1 and 1.1.2 in the Copy dialog choose Change format



For example the tag formatted with 3 sectors must be expanded to 5 sectors. Now click OK, the tag will be migrated witout any further confirmation.

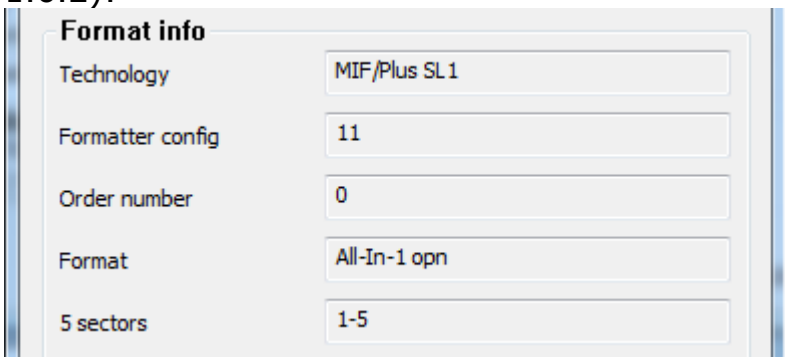
1.3.1 The tag is written OK



The further behaviour is the same as by formatting.

1.3.2 Verify the format info

Now click on the prompt Formatted and the tag info appears (same dialog as 1.6.2):



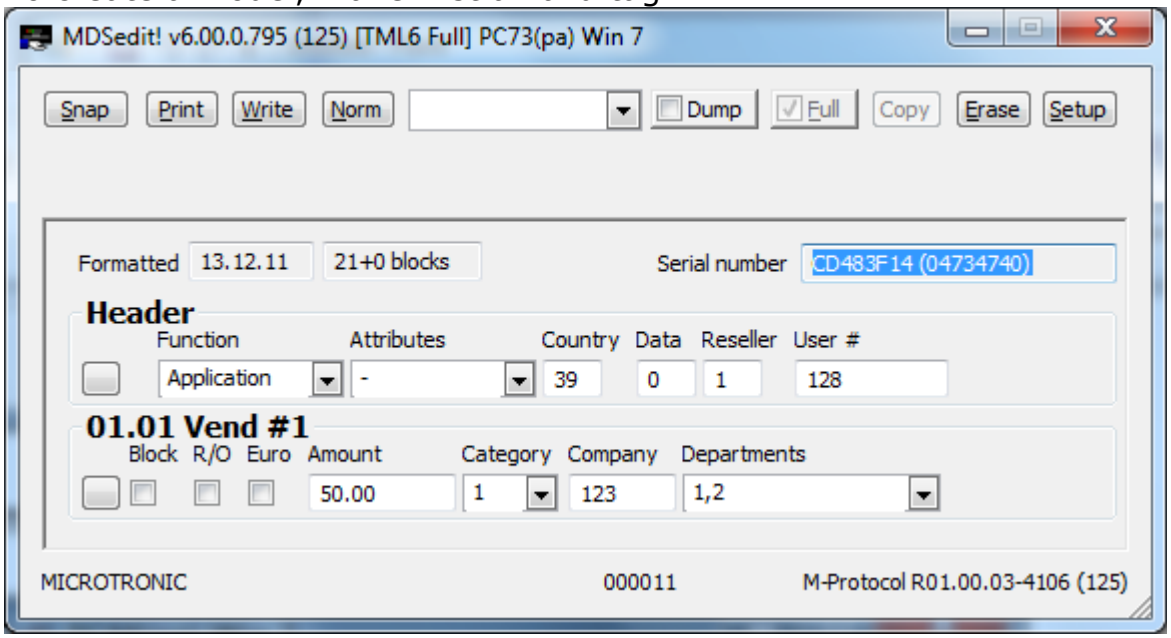
Under Format info verify the 5 sectors (now), All-In-1 open (choosen in the example at 1.4.3) **the test is done!**

1.4 Working with models

An alternative way to format/migrate/update badges is using the model, the advantage is that the reader has not to be connected to a PC.

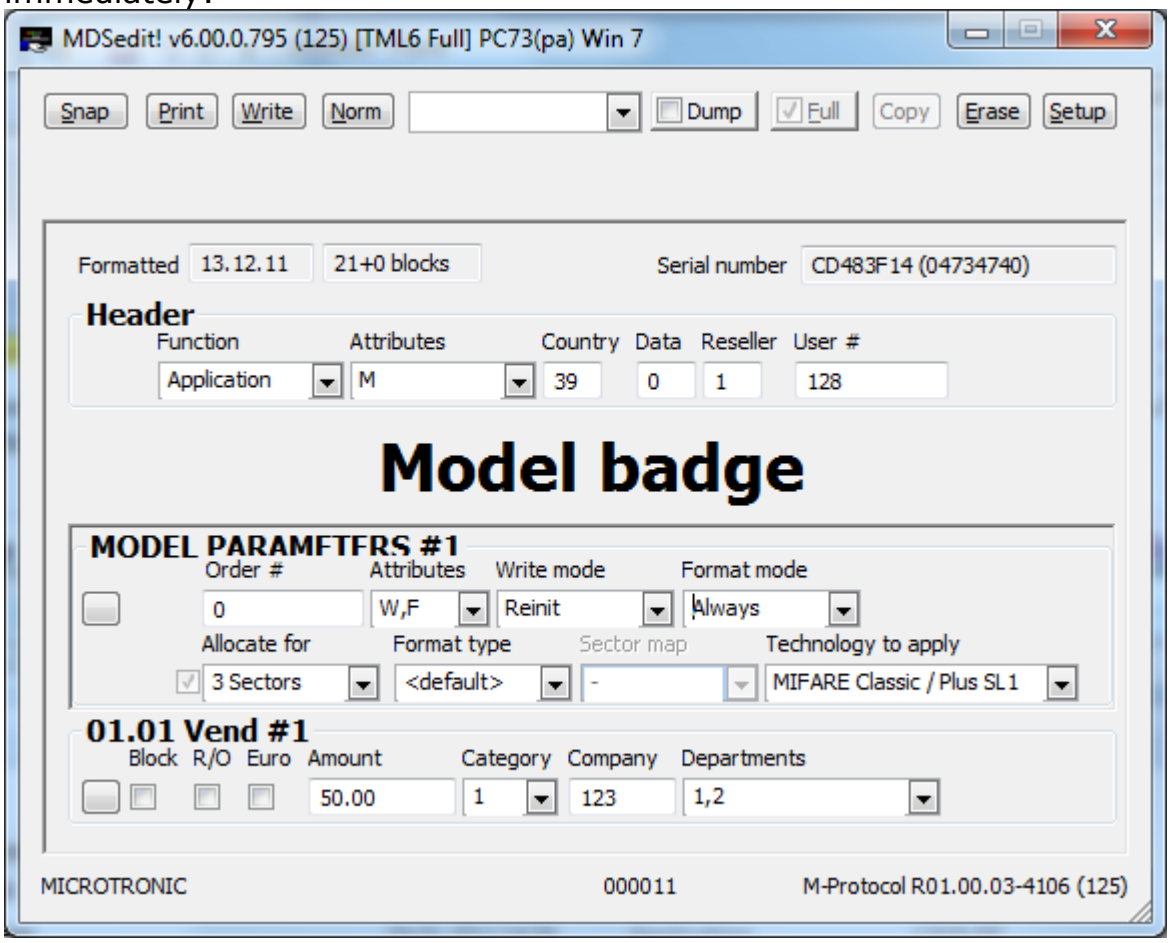
1.4.1 Creating a model

To create a model, make first a valid tag:



Then in the attributes check

, the model parameter block appear immediately:

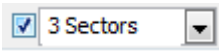


In fact this is no other as the Copy dialog shrunk in 1 block; just the Attributes, Write mode and Format mode have another outfit.

Once all parameters OK, click Write and the model is ready to use.

1.4.2 Model considerations

On models, some rules have to be observed:

- **There is no unformat per model.**
- **The model may be of any technology, format type or size, totally independent of the target formatting.**
- A model must have room for at least 3 log blocks.
- The model must have at **least 1 CC Block** (e.g. Vend #1), that have to be in the range of the reader configuration.
- On migrate models no care is taken of the log blocks of the model, the log blocks of the target badges are **left unchanged**, the required CC Block is to verify the access rights.
- On migrate models, the checkbox 

becomes active, uncheck it means keep the allocation, just change the format type.
- On models for CALYPSO®, format and migrate have another signification, explained in chapter 4.2.

1.4.3 Using a model

A reader in the idle state:

```
PRESENT MODEL
To start session
```

Insert a model (here a format model):

```
SESSION STARTED
To format ...
REMOVE MODEL TAG
```

The reader has read in the model parameters and is now ready to accept the 1st tag:

```
PRESENT NEXT TAG
Number:      124
Licences: 904
```

The reader informs you that the next tag will become user # 124 and it remains licences for format 904 badges.

Now insert the next **non formatted** tag:

```
Formatting ...
      ●●●●●●
DON'T REMOVE TAG
```

The formatting process duration may be some seconds, depending the tag size and what is to be done; once formatted OK, the confirmation is shown:

```
User       124
Written - OK
REMOVE USER TAG
```

And the reader is ready for the next tag:

```
PRESENT NEXT TAG
Number:      125
Licences: 903
```

After the last tag is formatted, insert the model again, so that the user-# can be updated there:

```
Model updated
Session closed
REMOVE MODEL TAG
```

And the reader returns in the idle state:

```
PRESENT MODEL
To start session
```

If any error occurs, the reader shows it like:

```
REJECTED   18.12
Tag is already
formatted
```

If the model is for migrate, the next tag is requested so:

```
PRESENT USER TAG
To migrate ...
```

And after finishing, it's not necessary to reinsert the model (there is no user-# to keep), reinserting the model will just close the session:

```
Session closed
By model tag
REMOVE MODEL TAG
```

And the reader returns to idle state.

It may (often) happen, that the reader in powered off before the model is updated; don't worry, the update data is kept in non-volatile RAM, and the next startup of the reader will show like:

```
PRESENT MODEL
with SN 637DDAE1
```

Insert this model tag to update it:

```
Model updated
Session closed
REMOVE MODEL TAG
```

If the model tag has been definitively lost, a special diagnostic tag may be used to unblock the reader.

1.5 Format Licenses/ Units

1.5.1 Licenses or Units

On a G5 reader the only technology available is mifare® CLASSIC™, and for the right to use the U-KEY structure, the formatting of each tag costs 1 **license**.

On a G6 reader, 4 technologies were initially available, and the licenses have different prices depending on the technology; a format currency has been created called **units**, the price list is delivered with the configuration document.

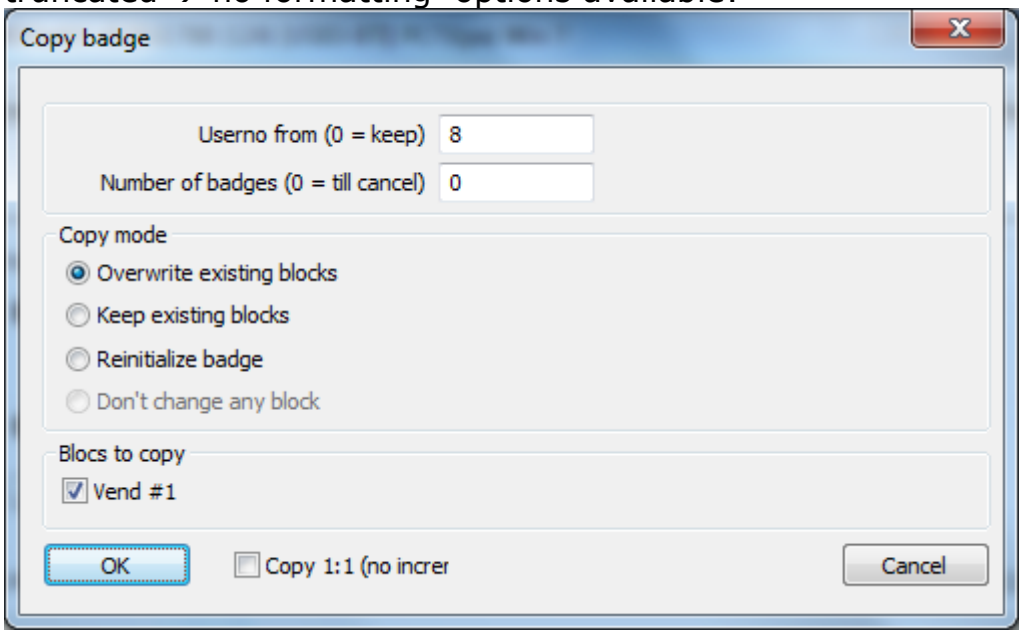
The G6 reader worked with licenses up to M-Protocol rev. 125, at the 1st start on rev > 125, the license accounts are converted **1** license = **10** units.

1.5.2 Obtaining licenses or units

The licenses or units may be obtained on three ways:

- Order a license or unit tag by MICROTRONIC
- Order licenses or units online by MICROTRONIC via e-mail
- Transfer licenses or units from one reader to another

If the reader never had format licenses or units, the copy dialog appears truncated → no formatting options available:

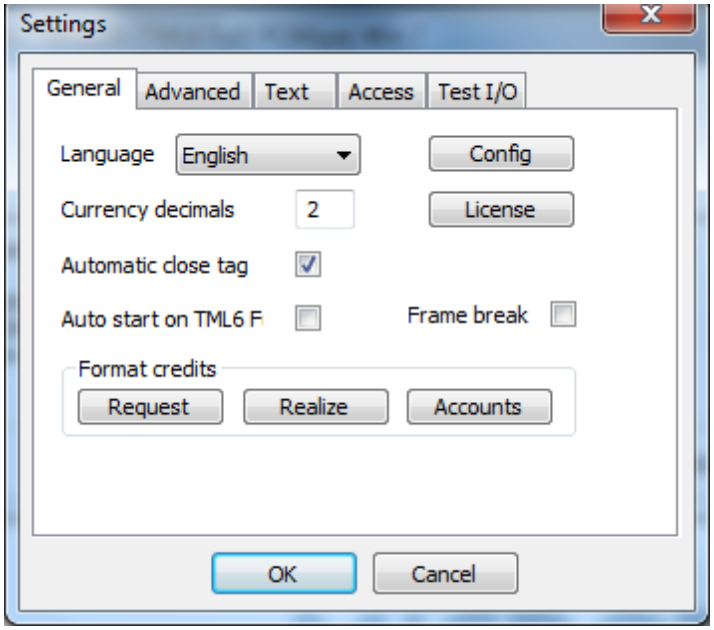


1.5.3 MICROTRONIC license or unit tag

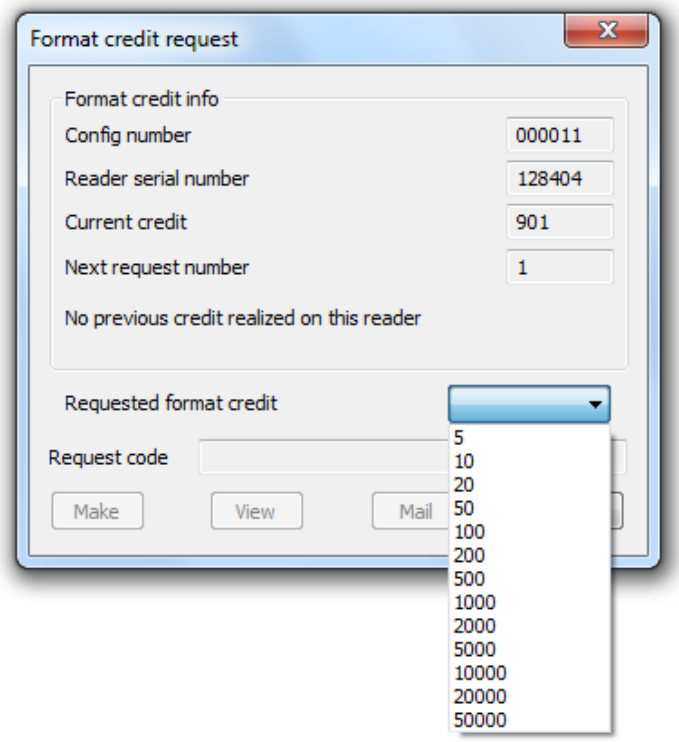
This was the 1st method to be used.

1.5.4 Order licenses or units by e-mail

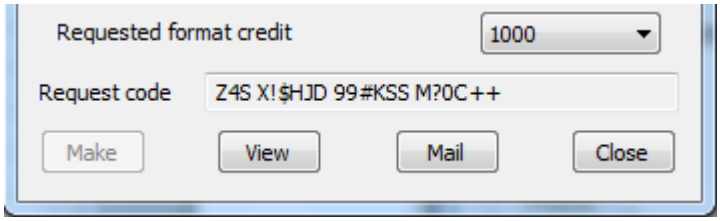
This is the most used method, click Setup:



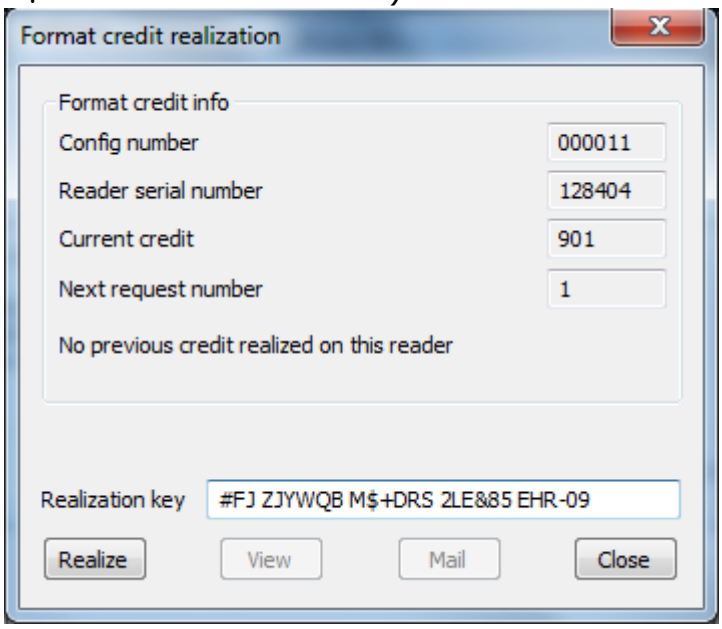
Then Request



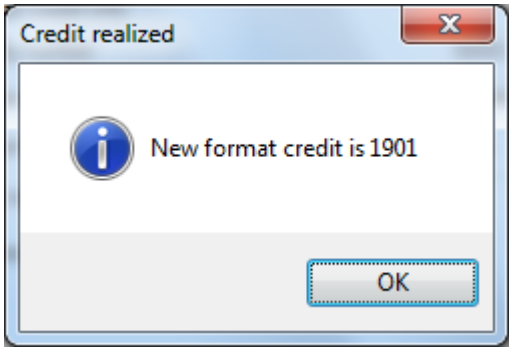
Choose the number of licenses or units needed



And with Mail send the request to MICROTRONIC, after reception of the response (and the bill), go back to the setup and click Realize and enter or paste the realization key obtained from MICROTRONIC (in our case **#FJ ZJYWQB M$+DRS 2LE&85 EHR-09**)



Clicking Realize realizes and the new credit is shown:

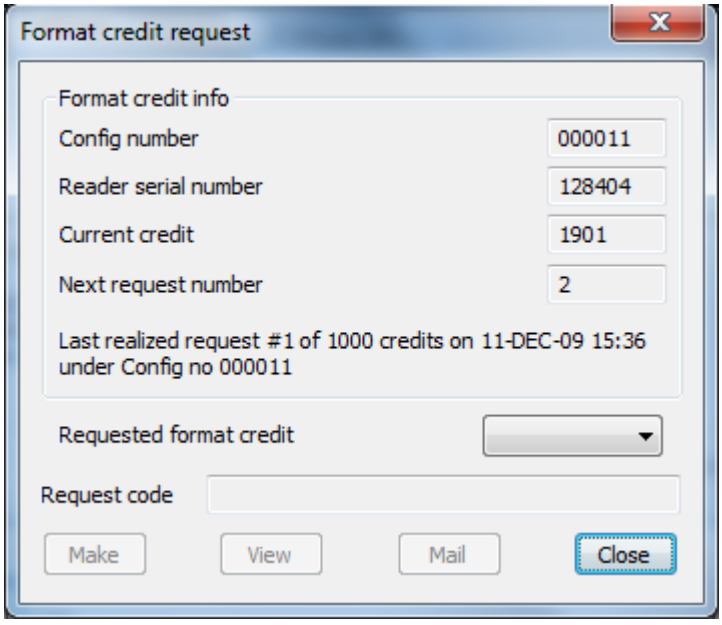


For information about the last transaction, click Request

The character set in the request / realize codes is

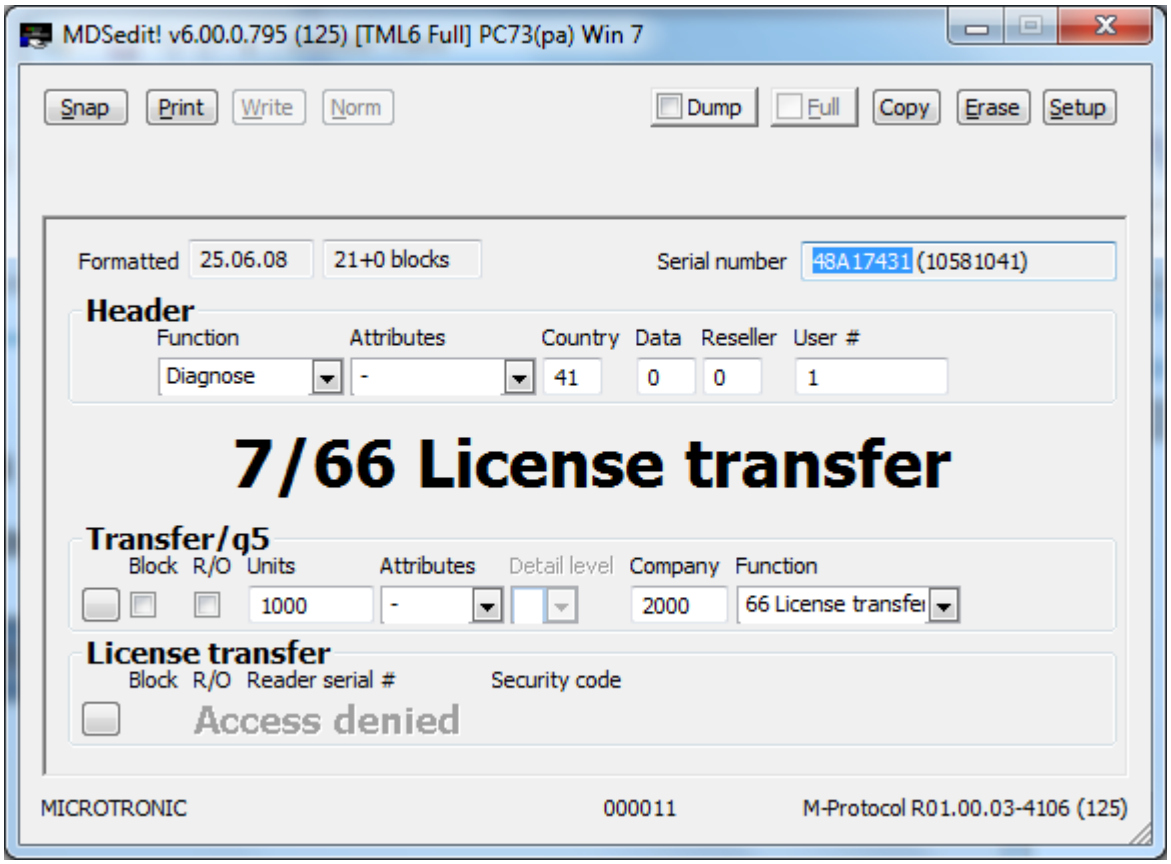
0123456789ABCDEFGHJKLMNPQRSTUVWXYZ%&$+=#!?

The letters **I** and **O** are not user to avoid confusion if the codes must be communicated by phone or fax (it happened).

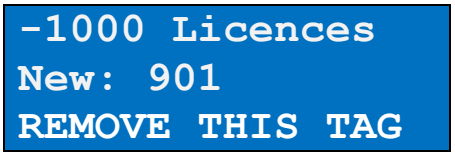


1.5.5 Transfer from a reader to another

Create a license / unit transfer tag:



Insert this tag in the reader whose licenses or units are to be taken from:



Then insert the tag in the reader that will obtain the licenses / units:

```
+1000 Licences
New: 1007
REMOVE THIS TAG
```

After the transfer, the tag transformed to license / unit info request.

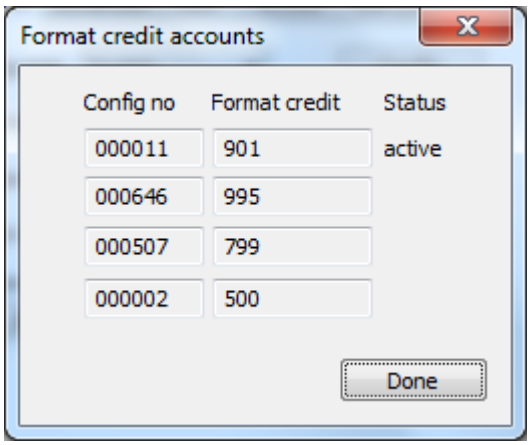
```
Remain: 1007
licences
REMOVE THIS TAG
```

Note that this operation can only be done from one reader to **another**:

```
Cannot transfer
To same reader
REMOVE THIS TAG
```

1.5.6 Checking license / units accounts

In its life, the reader may become different configurations, due to the license / unit price policy, the reader maintain a license account per configuration, to view the license account state, click Setup than Accounts:



The configuration marked active is the one currently loaded in the reader.

1.6 Available technologies

	MIFARE ultra light	MIFARE mini	MIFARE Classic	MIFARE Plus SL0	MIFARE Plus SL1
G5 Reader	**I**	**I W**	**I F W**	**I**	**I F W**
G6 Reader	**-**	**I F W**	**I F W**	**I F**	**I F W**

	MIFARE Plus SL2	MIFARE Plus SL3	DESFire	DESFire EV1	Calypso
G5 Reader	**I**	**I**	**I**	*****	**-**
G6 Reader	**-**	**I F W**	**I F W**	**I F W**	**I F W****

* G5 Reader simply identifies the tag as a DESFire, and that's it.
** only with MICROpay6

Legend:

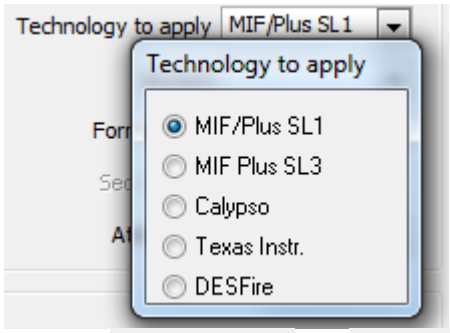
- **I** The technology can be identified by **MIFdump**.
- **F** The technology can be formatted by M-Protocol or Model Tag.
- **W** Working technology for operational use by M-Protocol or Model Tag.

2. Mifare® CLASSIC™, PLUS™

1.1 Technology to apply

TML6 is able to operate with mifare® CLASSIC™ and PLUS™ SL1 and mifare® PLUS™ SL3 tags. The sector topology is the same for all these types.

On the Copy dialog (see 1.1.2), select the technology:



Either or

Tag types

mifare® PLUS™ Security Levels

There are 4 **S**ecurity **L**evels on mifare® PLUS™:

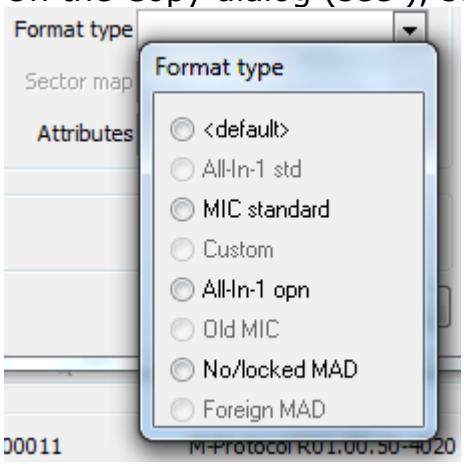
- **SL0** the Tag is virgin, and can only be written (master keys) but not be read, and there is no access key.
- **SL1** The tag behaves like a mifare® CLASSIC™ (6-Byte access codes, CRYPTO1 encryption) and is 100% compatible.
- **SL2** is something between SL1 and SL3, not supported by MICROTRONIC.
- **SL3** the highest security level (16-Byte access codes, AES encryption).

SL0 is only supported by readers of generation 6. So if an SL1 tag must work on readers of generation 6 it needs a by readers of generation 6 to format it.
SL2 is not supported

1.2 Format type

The Mifare® Application directory MAD may be used or not.

On the Copy dialog (see), select the Format Type:



The recommended format type is "MIC standard".
The <default> option takes the settings in the reader configuration.

1.2.1 Tags with MAD

Tags with MAD may have the following types (differentiated by the B key)

- **MIC standard**: same as ALL-IN-1 open, with the control block of sector **0** and **16** frozen.
- **ALL-IN-1 open**: B key is B0..B5 (resp. 2 * B0..B7 on SL3).
- **No/Locked MAD**: There is a valid MAD on the tag, but the U-KEY partition is not referenced there.
- **Invalid MAD**: The content of sector 0 is not readable or cannot be considered as a MAD (NXP AN10787_6).

The grayed options are recognized as such, but can't be given.

Unless 'keep virgin' is specified, all unused sectors are initialized with the same A and B key as the MAD and their data blocks zeroed.

1.2.2 Non-MAD tags

The tag comes from a 3rd party furnisher and the B key of MAD and the free sectors are not known by the reader for format (so it can't be written), or a MAD exists and is writeable, but we want deliberately work without MAD.

- ⇨ Only the used sectors are written.
- ⇨ Extended partition or NFC encryption requires a MAD.
- ⇨ Giving 1 to 5 sectors requires the start sector number in the reader configuration.
- ⇨ If 0, use a sector map.

If a MAD already exists (writeable or not), it will be left unchanged.

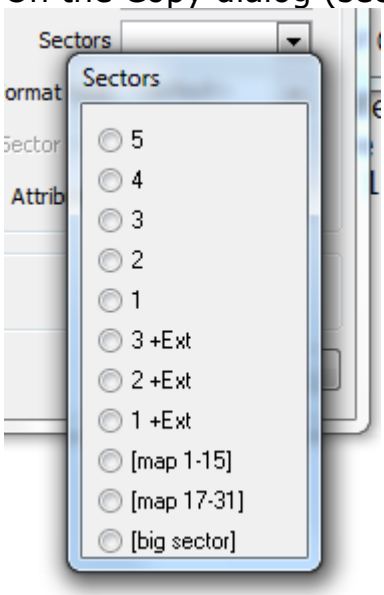
The application reader scans the sectors backward from the last (depending of the tag capacity) to sector 1 for find the 1st U-KEY sector, then forward to find the next. So it's an advantage to format the *n* last sectors (per sector map).

1.3 Sectors

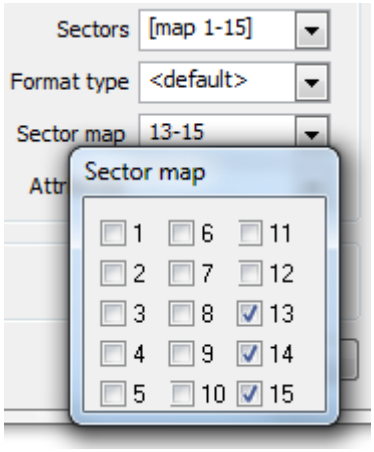
The sector size determines the max number of logical blocks:

1 sector:	1	logical block	64	bytes
2 sectors:	7	logical blocks	128	bytes
3 sectors:	12	logical blocks	192	bytes
4 sectors:	17	logical blocks	256	bytes
5 sectors:	23	logical blocks	320	bytes
1 big sector:	23	logical blocks	256	bytes

On the Copy dialog (see 1.1.2), select Sectors:



Choosing a "map" or "big sector" enables the Sector map option:



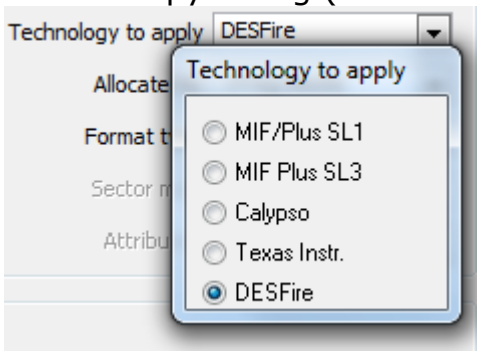
Allocation of sectors:

- **1 to 5 sectors**: sectors are allocated straightforward among the free sectors as defined by the MAD from a specific sector on (if no MAD).
- **1 to 3 sectors + Ext**: sectors are allocated straightforward among the free sectors as defined by the MAD (**required)**, and the whole rest of the sectors are allocated for the tag file.
- **Sector map**: sectors are allocated according a bitmap in the range 1-15 or 17-31, or 1 (big) sector in the range 32-39. The MAD is optional.

+ Ext partition: the MAD is **required**.

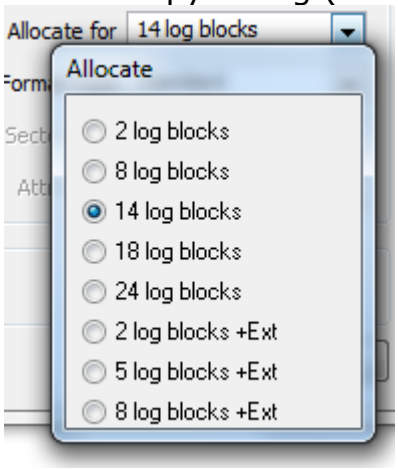
3. Mifare® DESFire™

On the Copy dialog (see 1.4.2), select the technology:



1.4 Allocation

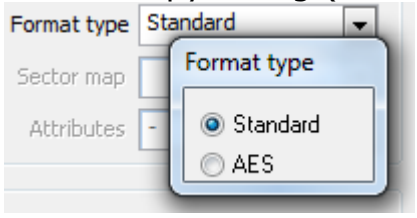
On the Copy dialog (see1.1.2), select the Format Allocation:



Log.Blocks	File Size	Phys Size	# of DESF blocks
2	32	64	1
8	96	192	3
14	160	320	5
18	192	384	6
24	256	512	8

1.1 On-chip encryption

On the Copy dialog (see 1.4.2), select the Format Type:

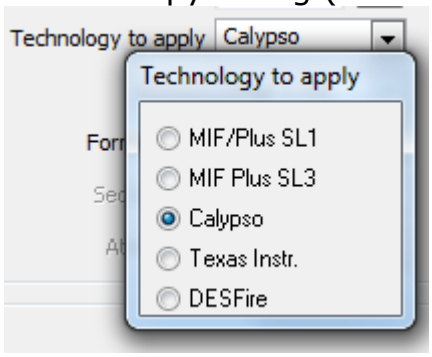


The App A003 is able to operate with DESFire™ tags, there are 2 format types:

- **Standard** (= 3DES)
- **AES**

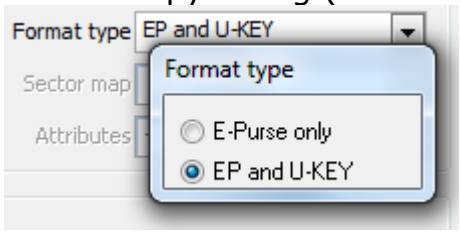
4. CALYPSO®

On the Copy dialog (see1.1.2), select the technology:



1.2 Allocation

On the Copy dialog (see1.1.2), select the Format Type:



The App A003 is able to operate with CALYPSO® tags, there are three format types:

- **Virgin**: the tag as furnished, this state cannot be restored.
- **E-Purse only**: only the built-in electronic purse is used.
- **EP & U-KEY**: the electronic purse and room for 9 logical blocks

The Reader is not able to unformat CALYPSO®.

1.3 CALYPSO® built-in E-Purse

The amount of VEND 1 (but not the one of VEND 2) is stored in the built-in E-Purse, and not in the tag data.

On **E-Purse only**, the Header 2 and the VEND 1 are faked by the reader.
On **EP & U-KEY**, the Header 2 and the block data are stored on the tag data.

The built-in E-Purse has some restrictions:

- The maximum amount on VEND1 is 0x7EFFFF (8323071)
- The debit is maximum 32767 per step; an amount 8323071 will need at least 255 steps to be reset to 0.
- The reader does not perform a loop; an error 12.71 is thrown if a debit is too large.

1.4 Format vs. Migrate

On CALYPSO® badges, the notions of format and migrate are overlapped.

from	to	E-Purse only	EP & U-KEY
Virgin		Format	Format
E-Purse only		-	Format or Migrate
EP & U-KEY		Migrate†	-

†Only in interactive mode.

1.5 EP & U-KEY -> E-Purse only

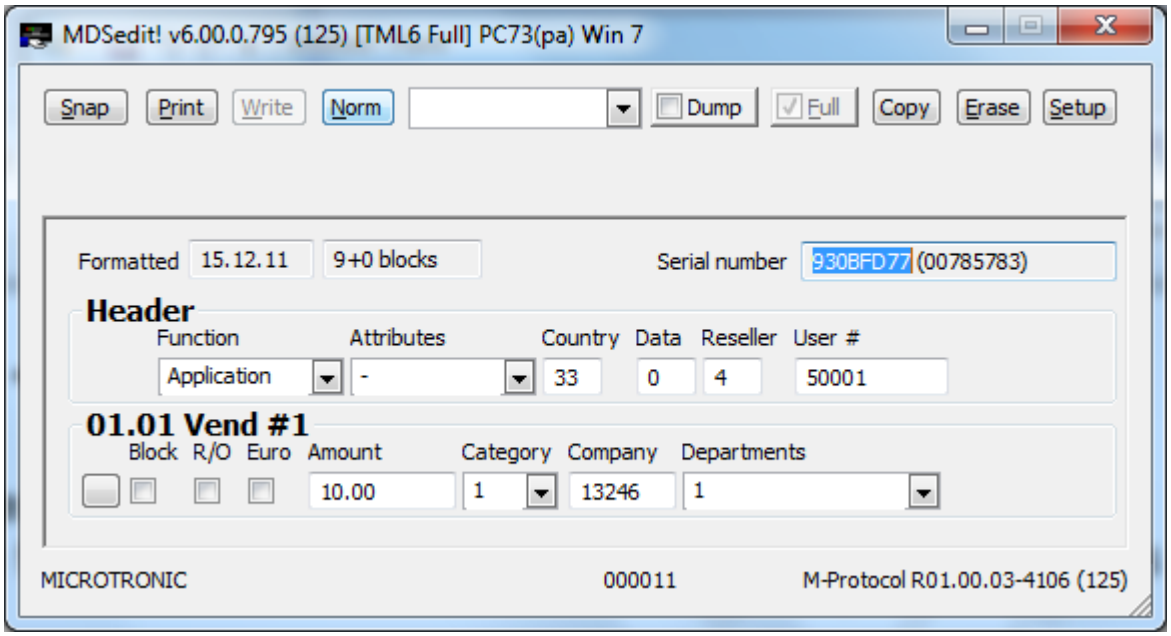
This operation has only a meaning if **E-Purse only** badges are needed for testing format/migrate to **EP & U-KEY**; the procedure is:

- Delete all log blocks except **Vend #1**
- Migrate to **E-Purse only**

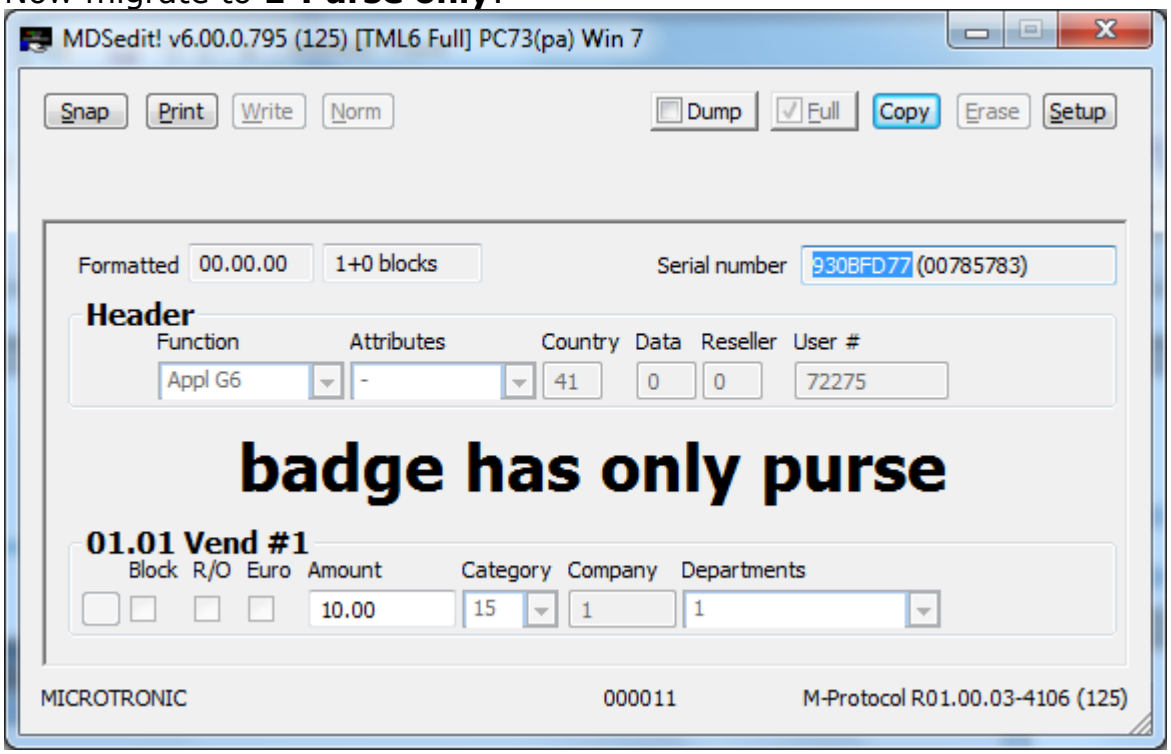
If other log blocks exist at migration, error 14.09 will be thrown.

1.6 E-Purse only -> EP & U-KEY

An **E-Purse only** tag has only the Amount value effectively stored on the tag; the other fields are faked resp. generated by the reader. This tag is **EP & U-KEY**:



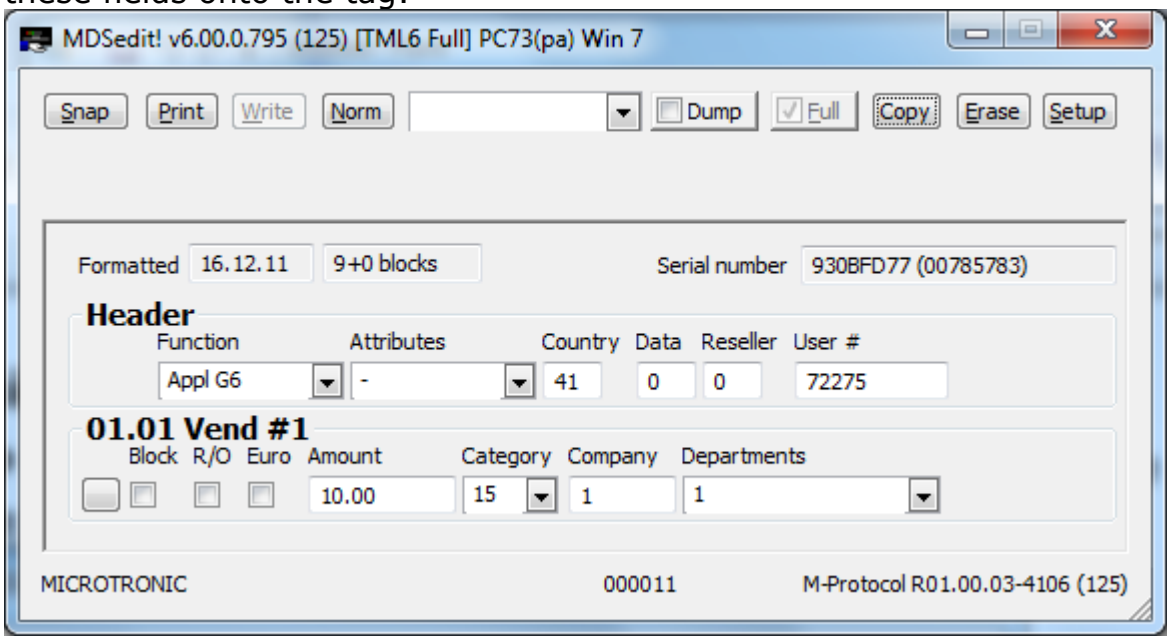
Now migrate to **E-Purse only**:



The Country and Company code and Departments are taken from the the reader configuration, the User # is computed by the reader and the Category is a fixed value in the reader (therefore read-only on **MDSedit**).

1.6.1 Interactive migrate

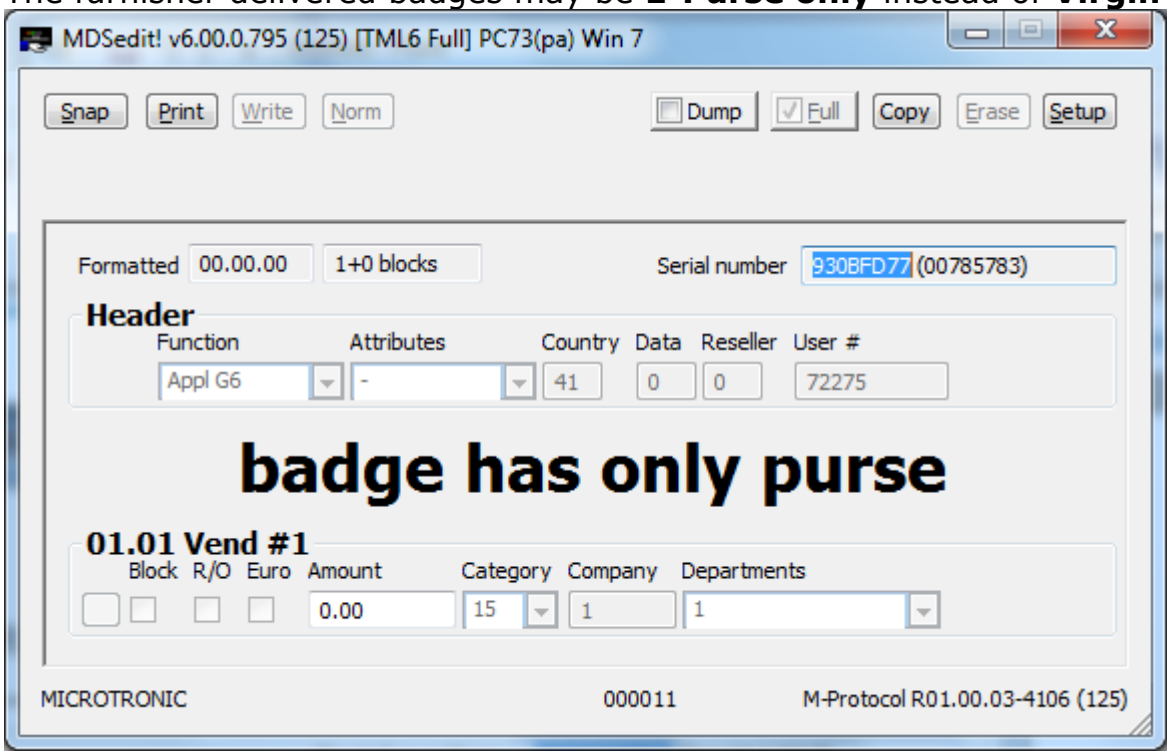
Interactively migrate to **EP & U-KEY** will create the U-KEY partition and write these fields onto the tag:



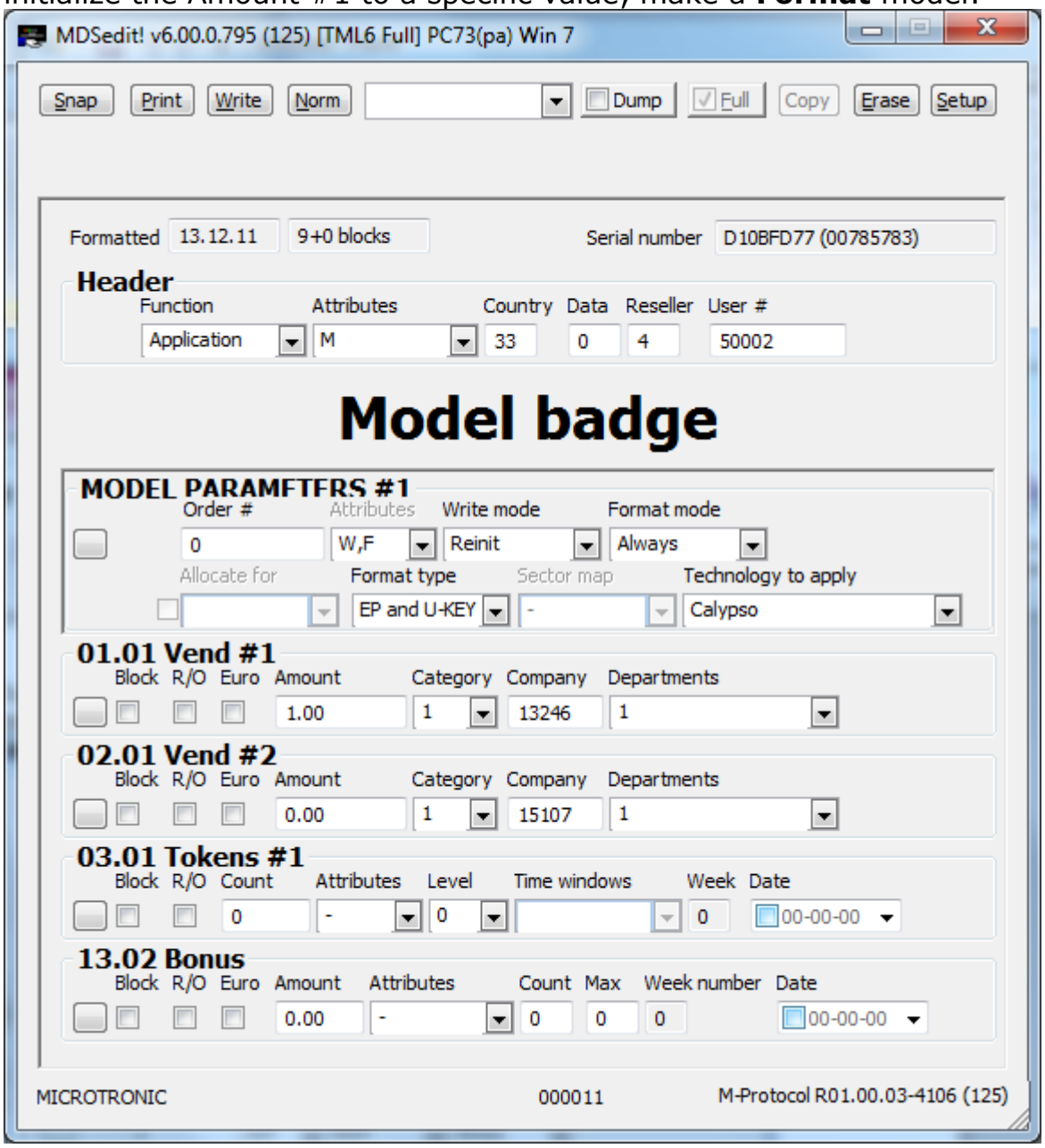
Now, they can be modified.

1.6.2 Format per Model

The furnisher delivered badges may be **E-Purse only** instead of **Virgin**



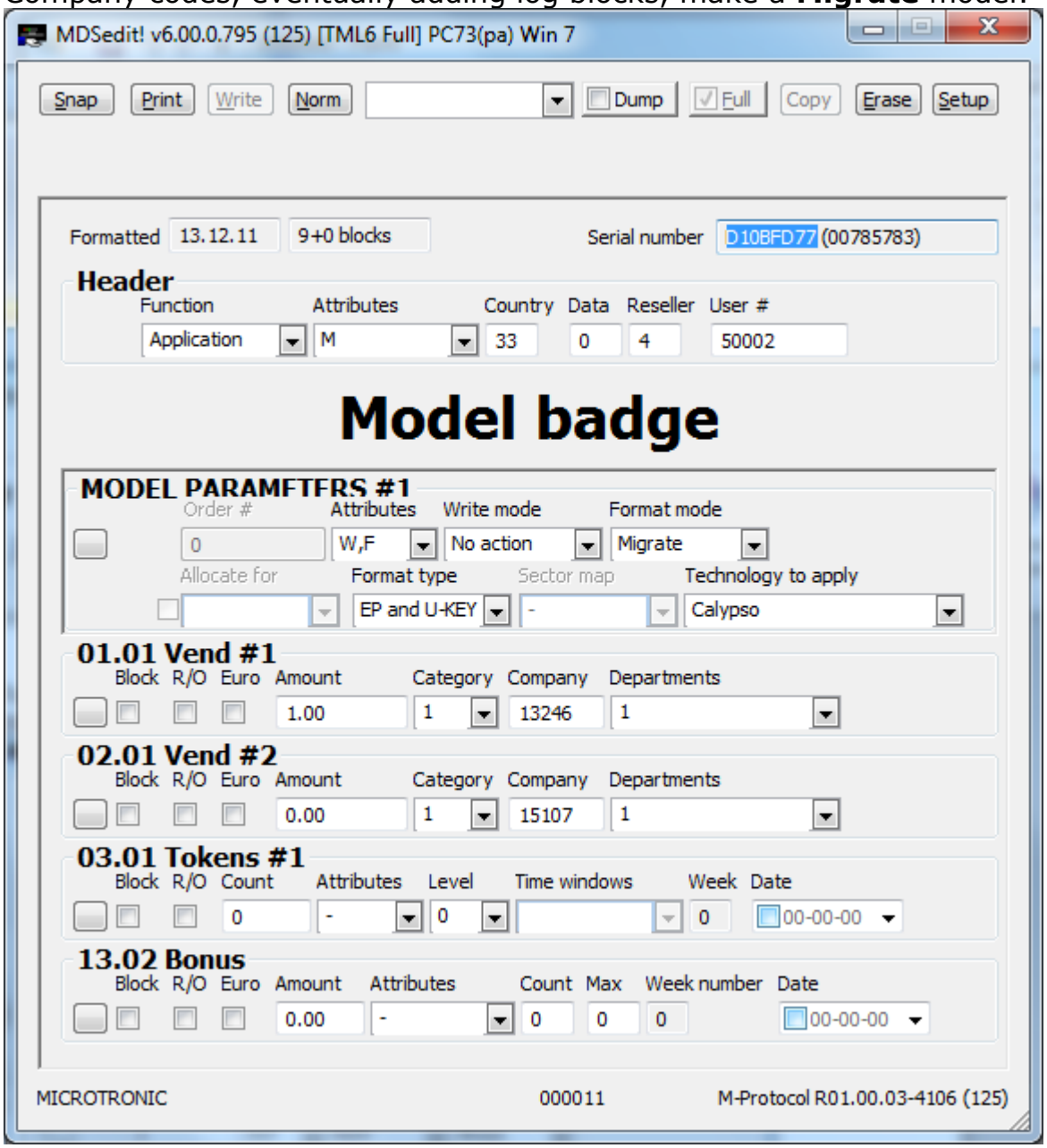
To make **EP & U-KEY** badges with specific Country and Company codes and initialize the Amount #1 to a specific value, make a **Format** model:



Take care on the built-in E-Purse restrictions.

1.6.3 Migrate per Model

If the badges are **E-Purse only** and have been used before, the amount field is considered valid and must be preserved while replacing the Country and Company codes, eventually adding log blocks, make a **Migrate** model:



In this case only (Migrate E-Purse only -> EP & U-KEY), the behavior of the reader is the same as with a format model (Increment User-#, consume license, update model at close); the only difference with a format model is that the amount value is preserved on the tag.